REMARKS

Applicants have received and carefully reviewed the Office Action mailed March 4, 2010. Applicants respectfully traverse (and do not concede) all objections, rejections, and adverse assertions made by the Examiner. With this paper, claims 1, 5, 11, 16, and 25 have been amended. Support for the amendments is found in the specification (see, for example, page 14, lines 19-26), claims, and drawings as originally filed. No new matter has been added. Claims 1-29 remain pending, with claims 6-10, 17-24, and 26-29 previously withdrawn. Favorable consideration of the above amendments and the following remarks is respectfully requested.

Specification

The specification has been objected to because of a typographical error. The specification has been amended accordingly and withdrawal of the objection is respectfully requested.

Claim Rejections Under 35 U.S.C. §112

Claims 1-5, 11-16, and 25 have been rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, there appears to be a typographical error with the formula. The claims have been amended accordingly. Reconsideration and withdrawal of the rejection are respectfully requested.

Claim Rejections Under 35 U.S.C. §103

Claims 1-4 and 25 have been rejected under 35 U.S.C §103(a) as being unpatentable over Earls et al. (U.S. Patent No. 5,391,651). Applicants respectfully traverse the rejection.

Turning first to independent claim 1, which, as amended, recites:

> 1. (Currently Amended) An epoxy resin composite formed article composed of an epoxy resin and fibers,

wherein fiber axes of the fibers are arranged along a first plane in at least two directions and molecular chains of the epoxy resin are oriented in a direction ~~intersecting with~~ perpendicular to the first plane therein,

wherein a degree of orientation α of the molecular chains of the epoxy resin is in a range of 0.5 or more and less than 1, as determined by the following expression (1) based on X-ray diffraction measurement,

$$\text{Degree of orientation } \alpha = (180 - \Delta\beta)/180 \quad (1)$$

wherein $\Delta\beta$ represents a full width at half maximum in an intensity distribution measured in an azimuth angle direction from 0 to 360° at a fixed peak scatter angle in the X-ray diffraction measurement, and

wherein each of the thermal expansion coefficients of the epoxy resin composite formed article in the direction along the first plane and in the direction intersecting with the first plane is in a range of 5×10^{-6} to 50×10^{-6} (/K) and a difference between the thermal expansion coefficients in the direction along the first plane and in the direction intersecting with the first plane is 30×10^{-6} (/K) or less.

As can be seen, the present claim is directed towards an epoxy resin composite composed of an epoxy resin and fibers. One feature of the invention is that fiber axes of the fibers are arranged along a first plane in at least two directions and molecular chains of the epoxy resin or the thermoplastic polymer are oriented in a direction perpendicular to the first plane therein. Accordingly, thermal expansion is isotropically reduced in each of a direction extending along the surface of the formed article and a direction perpendicular to said direction. Earls et al. do not appear to teach or suggest such a composite.

Earls et al. appear to disclose epoxy resins containing mesogenic moieties in which liquid-crystalline molecule chains are oriented by a magnetic field to enhance unidirectional mechanical properties. Earls et al. appear to disclose that epoxy resins containing mesogenic moieties and glass mat are used for reinforcing a molded article. Accordingly, molecule chains seem to be oriented along a surface of the article to enhance the mechanical properties. Nowhere do Earls et al. appear to teach or suggest in which direction the molecule chains are oriented or the molecule chain orientation relative to the glass mat.

Therefore, for at least theses reasons Earls et al. does not appear to teach or suggest the presently claimed epoxy resin composite. For similar reasons, as well as others, Earls et al. do not appear to teach or suggest the polymer composite of independent claim 25. Furthermore, there appears to be no motivation, suggestion or other reason for one of ordinary skill in the art to modify Earls et al. to arrive at the composite as claimed. Reconsideration and withdrawal of the rejection are respectfully requested. Applicants submit that claims 2-4 are also in condition for allowance as they depend from claim 1 and add significant limitations to further distinguish them from the prior art.

Claim 5 has been rejected under 35 U.S.C §103(a) as being unpatentable over Earls et al. (U.S. Patent No. 5,391,651) in view of Akatsuka et al. (U.S. Patent No. 6,261,481). Applicants respectfully traverse the rejection.

Turning to independent claim 5, which recites:

5. (Currently Amended) A printed wiring board comprising:

an epoxy resin composite formed article composed of an epoxy resin and fibers, wherein fiber axes of the fibers are arranged along a first plane in at least two directions and molecular chains of the epoxy resin are oriented in a direction ~~intersecting with~~ perpendicular to the first plane therein, wherein a degree of orientation α of the molecular chains of the epoxy resin is in a range of 0.5 or more and less than 1, as determined by the following expression (1) based on X-ray diffraction measurement,

Degree of orientation $\alpha = (180-\Delta\beta)/180$ (1)

wherein $\Delta\beta$ represents a full width at half maximum in an intensity distribution measured in an azimuth angle direction from 0 to 360° at a fixed peak scatter angle in the X-ray diffraction measurement, and wherein each of the thermal expansion coefficients of the epoxy resin composite formed article in the direction along the first plane and in the direction intersecting with the first plane is in a range of 5×10^{-6} to 50×10^{-6} (/K) and a difference between the thermal expansion coefficients in

the direction along the first plane and in the direction intersecting with the first plane is 30×10^{-6} (/K) or less, and

an electrically conductive layer provided on at least one of a surface and inside of the epoxy resin composite formed article.

As can be seen, the present claim is directed towards printed wiring board including an epoxy resin composite composed of an epoxy resin and fibers. One feature of the invention is that fiber axes of the fibers are arranged along a first plane in at least two directions and molecular chains of the epoxy resin or the thermoplastic polymer are oriented in a direction perpendicular to the first plane therein. Accordingly, thermal expansion is isotropically reduced in each of a direction extending along the surface of the formed article and a direction perpendicular to said direction. For at least the reasons set forth above, Earls et al. do not appear to teach or suggest such a composite.

Furthermore, Akatsuka et al. do not appear to teach that which Earls et al. lack. Akatsuka et al. appear to disclose that molecular chains of mesogenic group containing epoxy resin are oriented. However, Akatsuka et al. do not appear to teach or suggest the combination of polymer and fibers and the control of thermal expansion coefficients. Thus, even if one were to combine Earls et al. and Akatsuka et al., one would not arrive at the wiring board as claimed. Furthermore, there appears to be no motivation, suggestion or other reason for one of ordinary skill in the art to modify Earls et al. or Akatsuka et al. to arrive at the device as claimed. Reconsideration and withdrawal of the rejection are respectfully requested.

Claims 1-5, 11-16, and 25 have been rejected under 35 U.S.C §103(a) as being unpatentable over Tobita (U.S. Patent Pub. No. 2003/0003287) in view of Akatsuka et al. (U.S. Patent No. 6,261,481). Applicants respectfully traverse the rejection.

As discussed above, one feature of the invention is that fiber axes of the fibers are arranged along a first plane in at least two directions and molecular chains of the epoxy resin or the thermoplastic polymer are oriented in a direction perpendicular to the first plane therein. Accordingly, thermal expansion is isotropically reduced in each of a direction extending along the surface of the formed article and a direction perpendicular to said direction. Neither Tobita nor Akatsuka et al., taken alone or in combination, appear to teach or suggest such a composite.

Tobita appears to disclose a heat conductive resin substrate in which polybenzasol fibers are oriented in the resin substrate. Paragraph 0022 discloses thermoplastic resins including liquid crystal polymers that are used as a matrix material of the substrate. While Tobita appears to disclose that the fibers are oriented, Tobita does not appear to teach or suggest that the matrix material is oriented. Furthermore, Akatsuka et al. do not appear to teach that which Tobita lacks. Akatsuka et al. appear to disclose that molecular chains of mesogenic group containing epoxy resin are oriented. However, Akatsuka et al. do not appear to teach or suggest the combination of polymer and fibers and the control of thermal expansion coefficients. Therefore, neither Tobita nor Akatsuka et al. appear to teach or suggest the claimed orientation of the fibers and the epoxy resin or polymer. Thus, even if one were to combine Tobita and Akatsuka et al., one would not arrive at the device as claimed. Furthermore, there appears to be no motivation, suggestion or other reason for one of ordinary skill in the art to modify Tobita or Akatsuka et al. to arrive at the device as claimed. Reconsideration and withdrawal of the rejection are respectfully requested. Applicants submit that claims 2-4 and 12-15 are also in condition for allowance as they depend from one of claims 1 or 11 and add significant limitations to further distinguish them from the prior art.

Conclusion

Reconsideration and further examination are respectfully requested. It is respectfully submitted that all pending claims are now in condition for allowance. Issuance of a Notice of Allowance in due course is requested. If a telephone conference might be of assistance, please contact the undersigned attorney at (612) 677-9050.

Respectfully submitted,

Date: June 4 2010

Glenn M. Seager, Reg. No. 36,926
CROMPTON, SEAGER & TUFTE, LLC
1221 Nicollet Avenue, Suite 800
Minneapolis, Minnesota 55403-2420
Glenn.Seager@cstlaw.com
Tel: (612) 677-9050